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FARMERS' BULLETIN

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LABORATORY EXERCISES IN FARM MECHANICS FOR AGRICULTURAL HIGH SCHOOLS.

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DEC 22 1916

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INTRODUCTION.

High-school instruction in farm mechanics has been a recognized need for some time. The best and most economical methods for doing the mechanical work of the farm should be taught boys who are prospective farmers while they are pursuing a high-school course. It is the purpose of this bulletin to outline a limited number of suggestive exercises in farm mechanics to serve as a guide to the teacher of high-school agriculture. As the work progresses, the teacher should supplement these with additional exercises adapted to local conditions.

ROPE WORK.

EXERCISE 1. WHIPPING, CROWNING, AND GRANNY AND SQUARE KNOTS.

Equipment.—Each student should have 20 feet of $\frac{3}{4}$ -inch manila rope and 2 feet of strong cotton twine.

Instructions.—*Whipping.*—First unlay one strand as far back as you wish to whip the rope. Place one end of the cotton twine under the strand and then place the strand back where it was, as shown in figure 1A. Then wind the long end of the twine around the rope, being careful to pull it tight. When half of the distance is whipped, make a bight with the short end of the twine, as shown in figure 1B and continue whipping. Next pass the long end of the twine through the bight and pull tight, as shown in figure 1C. Pull on the free end of bight until the twine is drawn underneath as far as possible. Cut off the end of the twine and the whipping is complete, as shown in figure 1D.

Crowning.—Unlay the end of the rope 7 inches. Lay strand No. 1 between No. 2 and No. 3, leaving it as shown in figure 2A. Bring

NOTE.—This bulletin is intended primarily for the use of teachers of high-school agriculture.

strand No. 2 forward over No. 1, as shown in figure 2B. Pass strand No. 3 through the bight left in strand No. 1, as shown in figure 2C. Draw all the strands down tight. Each strand should now be spliced back. It should go over the nearest strand in the main rope and under the next strand (see fig. 2D). The strands should be worked back, one at a time. Care should be exercised to pull the strands tight. If they tend to twist and knot, untwist them before drawing

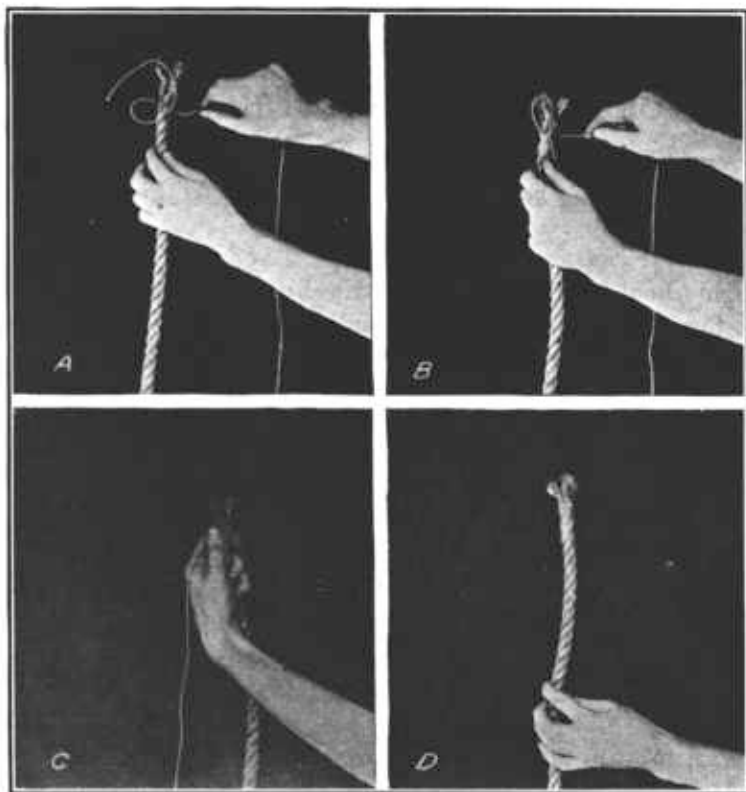


FIG. 1.—Whipping end of rope.

down tight, as shown in *a* of figure 2E. Complete crown will appear as shown in figure 2F.

Granny knot.—The granny knot is often tied for the square knot. It is liable to slip and become hard to untie after being pulled tight. Figure 3 shows the start, while figure 4 shows it completed just before being drawn tight. It will be noticed that ropes A and B are on opposite sides of C.

Square knot.—This knot holds well and is easy to untie after being pulled tight. Figure 3 shows it started and figure 5 completed before being drawn tight. It will be noticed that ropes A and B are on the same side of C.

EXERCISE 2. TYING KNOTS—HALF HITCH, SLIP, HITCHING, AND BOWLINE.

Equipment.—Rope used in exercise 1.

Instructions.—*Half hitch.*—A half hitch is shown in figure 6. It should be tied as shown in figure 7.

Slip knot.—Make a loop as shown in figure 8 and then pull the rope through as shown in figure 9.

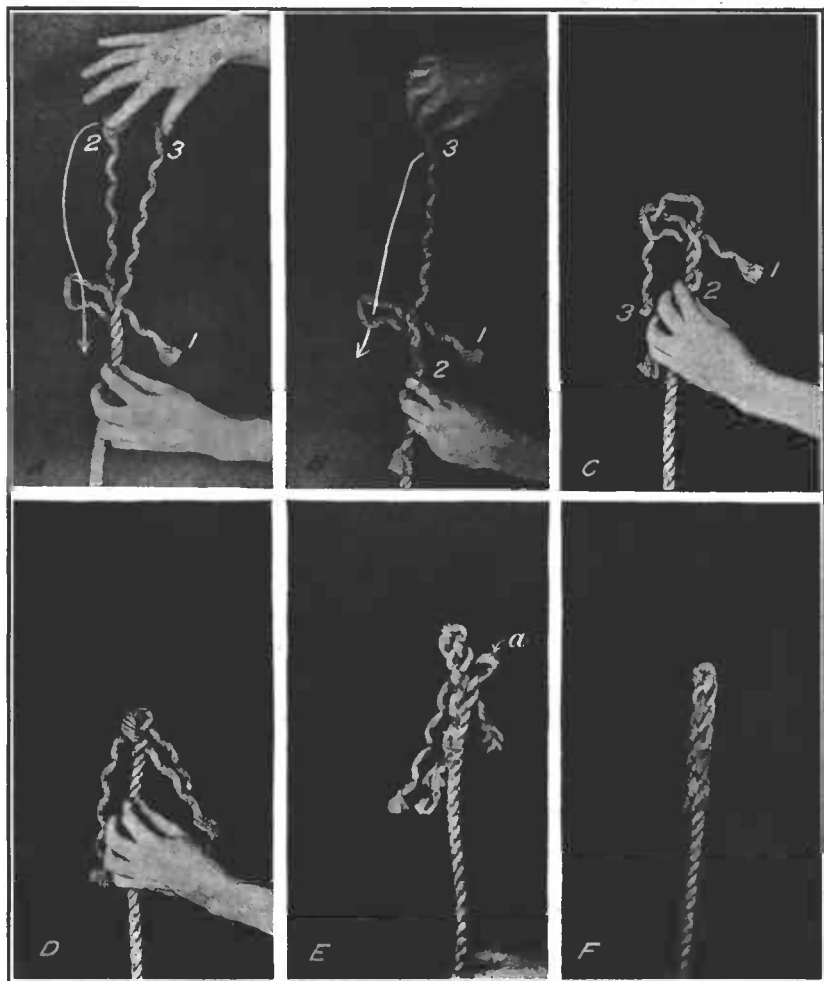


FIG. 2.—Crowning end of rope.

Hitching knot.—This knot is used principally for hitching horses. Pass one end of the rope around the post and hold it in the right hand with the left hand holding the rope, as shown in figure 10A. Pass the end around the rope and pull it through the loop, as shown in figure 10B. When pulling the rope through the loop, do not pull the

end through but form another loop and pass the end through the loop, as shown in figure 10C.

Bowline knot.—This knot is used where a loop is wanted that will not slip. Make loop in rope as shown in figures 11A and 11B. Draw the end through the small loop and pass it under and around the main loop, then down through the small top loop, as shown in figures 11C and 11D. Draw tight.

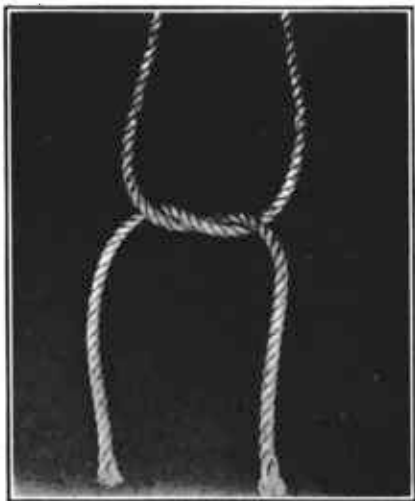


FIG. 3.—Start of granny and square knots.

a and *b*. Next tie the strands of the different ropes together with a simple knot, as shown in figure 12B, and pull knots tight. The splice now looks like figure 12C. Each strand should now be worked back over and under alternate strands of the main rope as was done in crowning. Figure 12D shows this started. Figure 13 shows finished splice. Part of each strand can be cut out toward the end and thus make the splice taper to the size of the rope.

Long splice.—This splice is used where two ends of rope are to be joined and the rope must run through a pulley. Unlay 24 inches of one strand on the ends of the ropes to be spliced and place them together, as shown in figure 14A. Then unlay strand *b* and follow up with strand *a* as fast as *b* is unlaid. Continue until about 6 inches of strand *a* is left, as shown in figure 14B. Untwist the other two strands of each rope and unlay *d* and follow with *c* (fig. 14C) the same as was done with *a* and *b*. Now the splice is in the condition shown

EXERCISE 3. LONG AND SHORT SPLICE.

Equipment.—Same rope as used in exercises 1 and 2.

Instructions.—*Short splice.*—In case the size of a rope is immaterial the short splice may be used to join the ends. First, untwist each end of the rope about 9 or 10 inches, then place the two ends together, as shown in figure 12A, having one strand of one rope between two strands of the other. That is, *a* is between *e* and *d* while *d* is between

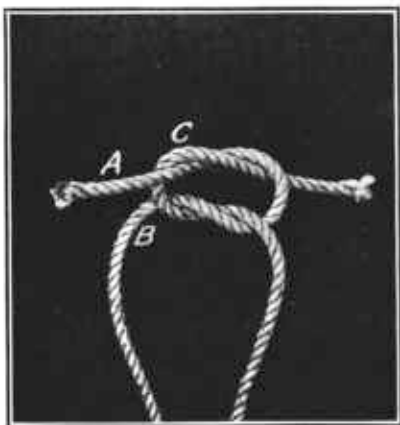


FIG. 4.—Granny knot.

in figure 14D. Tie each of two strands with common knots, as shown in figure 14E. Next place each strand over the nearest strand in the main rope and under the next, as shown in figure 14F and figure 15. Cut off the ends and the splice is finished.

EXERCISE 4. MAKING ROPE HALTER.

Equipment.—Rope used in other exercises.

Instructions.—First, crown one end of the rope. Next, form an eye on the rope at a point so that the short end of the rope is long enough to go over a horse's or cow's head, together with enough rope for splicing. To make the eye, lift one strand at *b*, figure 16A, and pass the long end under this strand. Then lift a strand on the long end and pull the short end through, as shown in figure 16B. This will complete the eye, figure 16C. Untwist the short end 6 or 8 inches, figure 16D, and splice this end into the long end of the rope. The completed halter is shown in figure 16E.



FIG. 5.—Square knot.

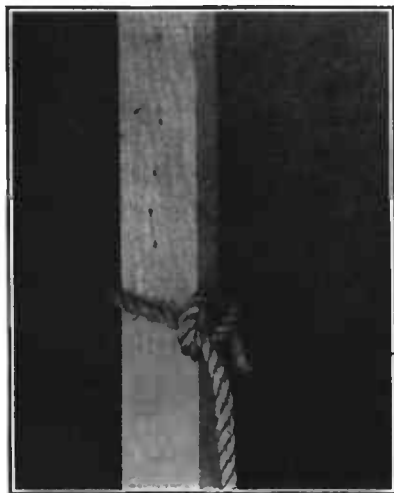


FIG. 6.—Half hitch.

EXERCISE 5. CASTING HORSES AND CATTLE.

Equipment.—Twenty feet $\frac{1}{2}$ -inch manila rope and four hobbles.

Instructions.—*Casting cattle.*—Tie the animal to be thrown to a post. Then tie one end of a $\frac{1}{2}$ -inch rope around the horns, or halter if cow has no horns; take a half hitch around the neck, another around the body just back of the fore legs, and the third one around the body just in front of the hind legs. Pull on the loose end to throw the animal (see fig. 17).

Casting horses.—To make hobble take 4 feet of $\frac{1}{2}$ -inch rope and an iron ring, as shown in figure 18A. Place one of these hobbles on each foot. Tie one end of $\frac{1}{2}$ -inch rope to left forward ankle. Pass

the rope through the ring of hobble on the left hind foot, next through the ring on right hind foot, then through the ring on the right fore foot, and finally through the ring on the left fore foot. Figure 18B shows the ropes on the horse. The horse is to be thrown on right side. To throw a horse, one person should pull on the loose end of the rope and another take hold of the halter (which should be strong) and pull the way the horse is to fall. Care should be taken not to throw the horse too hard, as a hip can be easily broken. After the horse is thrown, hold his head down to keep him from getting up.



FIG. 7.—Half hitch tied.

FARM POWER.

EXERCISE 6. FITTING COLLARS ON HORSES

Equipment.—Horse collars and horse.

Instructions.—Several collars should be tried on the horse to show good and bad fits. Figure 19A shows a collar which is too small. It does not sit down on the collar bed, where the hand is placed. Such a collar would have a tendency to choke the horse. Figure 19B shows the collar too large. There is room enough for a hand and arm to go between the collar and neck. Large collars, even when supplied with sweat pads, cause sore necks. Figure 19C shows a good fit.

EXERCISE 7. HITCHING UP ONE TO FOUR HORSES.

Equipment.—Four horses, two sets double harness, one set single harness.

Instructions.—Assign students the problem of arrangement of lines for one, two, three, and four horses, when hitched abreast, and in twos, with one team ahead of another. Have them work this out on paper the night before it is done in laboratory, then in the lab-



FIG. 8.—Start slip knot.

oratory have the students hitch the horses up as per sketches submitted, showing faults and merits of arrangements submitted.

EXERCISE 8. HITCHING UP FROM FIVE TO TEN HORSES.

Equipment.—Ten horses and five sets double harness.

Instructions.—Proceed the same way as in exercise 7. It may be well to give the students three or four days to work it out before taking up in laboratory. Have the arrangement of horses abreast in pairs—threes, fours, and fives. Pick out the best arrangement of lines and the poorest. Have the students try these out on the horses.

EXERCISE 9. REPAIR OF HARNESS.

Equipment.—Copper rivets, riveting machine, leather punch, awl, thread, wax, needles, wooden clamp or stitching horse.

Instructions.—In repairing harness with copper rivets a hole is punched and the rivet upset in place. Several machines are on the market for doing this kind of work.

Sewing is the best way of mending harness. When a harness-mending outfit is purchased, complete instructions come with it. A trip to the harness shop will also be profitable in determining how to sew harness.

EXERCISE 10. NAMING PARTS OF GAS ENGINES.

Equipment.—Gas engine.

Instructions.—Each student is to locate all the following parts and tell the function of each: Engine base, cylinder, cylinder head, inlet valve, exhaust valve, muffler, carburetor, needle valve, spark plug or igniter, piston, connecting rod, crank shaft, main bearings, crank-shaft bearings, flywheel, pulley, governor, magnet, and fuel tank.

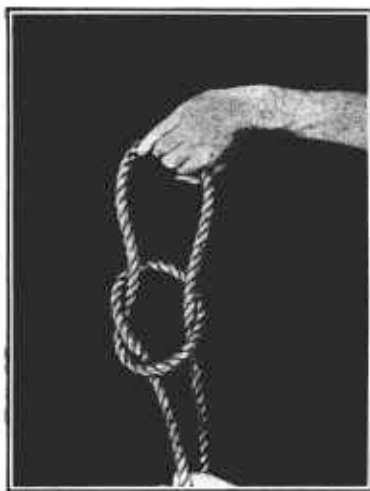


FIG. 9.—Finished slip knot.

EXERCISE 11. WIRING ENGINE.

Equipment.—Six or eight dry batteries, several short pieces of copper wire, spark coil or induction coil, and gas engine.

Instructions.—Each student is to take the above equipment, which usually comes with every engine, connect the batteries, attach the coil, and connect with the engine. Wiring instructions come with all engines, so the instructor can use them as a guide.

EXERCISE 12. RUNNING GAS ENGINE.

Equipment.—Same as exercises 10 and 11.

Instructions.—Each student should start, run, and stop the engine without assistance.

EXERCISE 13. TROUBLES ON GAS ENGINE.

Equipment.—Same as exercise 12.

Instructions.—The instructor should either disconnect a wire, cause a short circuit, empty gasoline tank, put water in gasoline, or in some other way put the engine in trouble, so it will not run. Let the students, in groups of two or three, hunt the trouble. *Do not let them give up.*

EXERCISE 14. BELT LACING.

Equipment.—Belt punch; pieces of cardboard; twine. Each student should be provided with two pieces of cardboard 3 inches wide

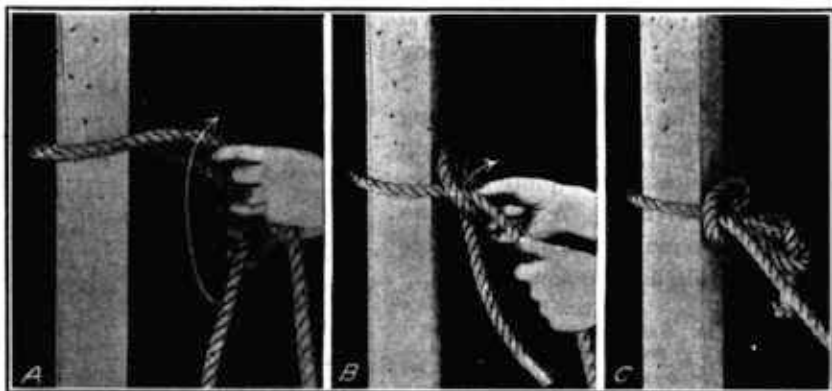


FIG. 10.—Hitching knot.

and 4 inches long, two pieces of cardboard 6 inches wide and 6 inches long, and some twine.

Instructions.—Mark one side of the cardboard “Hair or grain side.” The hair or grain side of the belt is the side from which the hair has been removed and is always placed next to the pulley.

Lacing 3-inch leather belt.—Punch holes in the cardboard of size just large enough to allow two thicknesses of twine to pass through. Have the holes arranged and spaced as shown in figure 20. With grain side of the two ends of belt down, pass one end of lace down through S and up through hole M, which should be made with an awl. Taking the other end of the lace, pass it through the following holes in order named: V, R, V, R, T, S, Y, X, Y, X, T, S, T, U (which should be made with an awl). Keep the lace pulled tight at all times. Cut the ends off and nick them, so the lace will not slip out.

Lacing 6-inch belt.—Punch holes in a belt or cardboard with spacing and arrangement shown in figure 21. With the grain side of the belt down, pass one end of the lace through hole C and up through hole D, which is made with an awl. Take the other end of the lace, which is the long end, and pass through the holes in the order named: B, C, G, H, G, H, K, L, K, L, O, P, O, P, N, M, N, M, J, I, J, I, F, E, F, E, B, C, B, and then through A, which is made with awl. Keep

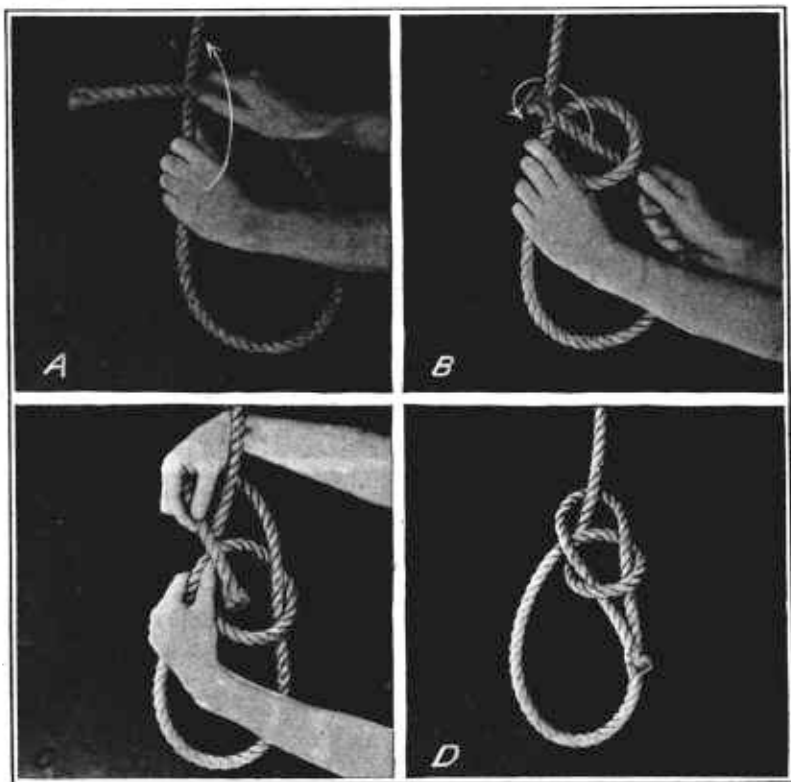


FIG. 11.—Bowline knot.

lace drawn tight when lacing. Cut off and nick ends, so the lacing will not come loose.

EXERCISE 15. SOLDERING.

Equipment.—Soldering iron; stick of solder; small bottle of muriatic acid; file or scraper. (Soldering iron and stick of solder can be purchased at most hardware stores. A small bottle of muriatic acid can be obtained at a drug store, and a piece of wire placed in the cork extending down into the acid can be used to apply it.)

Instruction.—Clean the surfaces to be soldered with a file, emery paper, or scraper. Drop some acid on the cleaned parts. Heat the

soldering iron. Experience will tell you how hot it ought to be. Have it sufficiently hot to melt the solder readily, but not so hot that it will pit the iron. Wipe it on a clean piece of cloth. The soldering iron and solder are brought together in such a manner as to allow the melted solder to drop on the part to be mended. When

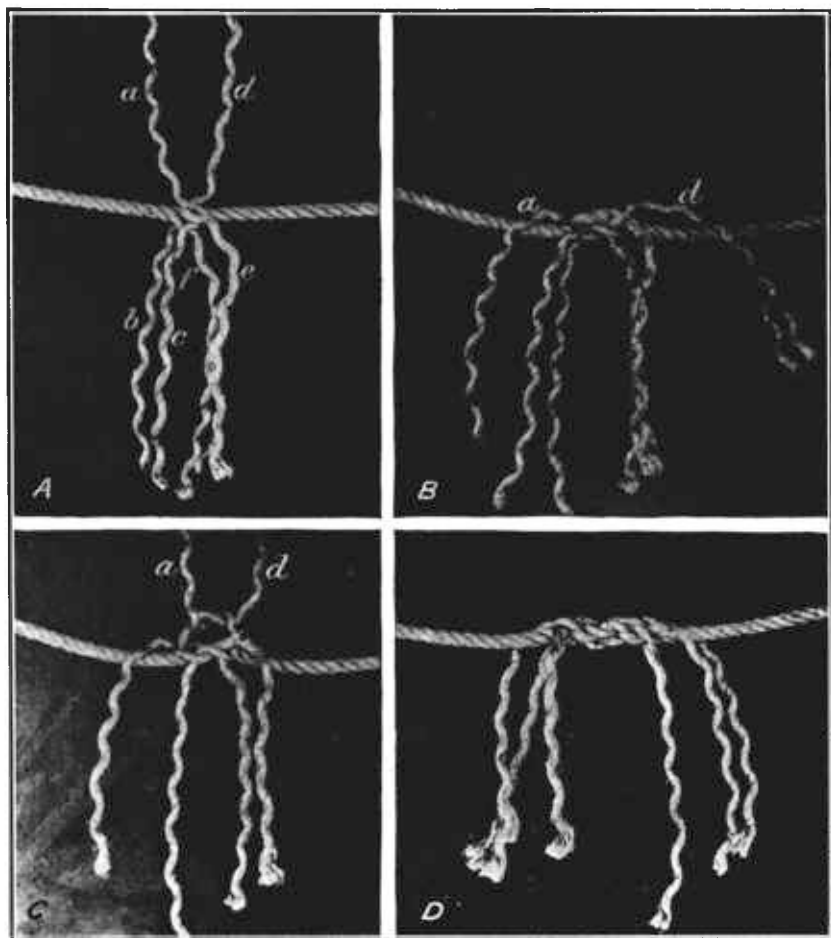


FIG. 12.—Splicing rope with short splice.

enough melted solder has accumulated to cover the place to be mended, smooth the joint by rubbing the iron over it. When starting to use the soldering iron, “tin” the end of it by heating it until it is just warm enough to melt the solder. Wipe it off and rub in some solder. This is done to keep the solder from adhering to the iron when soldering.

FARM BUILDINGS.

EXERCISE 16. CONCRETE POSTS.

Equipment.—Cement, sand, gravel, reinforcement, two shovels, mixing board, measuring box, and post forms.

Instructions.—Complete directions for building forms, size of reinforcement, and other valuable information can be found in Farmers' Bulletin No. 403. Have two or three students build a form that will hold five or six posts. Then have the students, in groups of three, fill the form each week. Care should be exercised to cure the posts well. By making posts this way they can be obtained cheap, and soon enough will be obtained to put up a fence. General instructions for mixing and placing concrete can be obtained from Farmers' Bulletin No. 461. Additional literature of this nature can be obtained free from manufacturers of cement, whose names and addresses can be found in farm papers.

EXERCISE 17. FEEDING FLOOR OR SIDEWALK.

Equipment.—Cement, sand, gravel, forms, three shovels, measuring box, tamper, steel trowel, and wooden trowel.

Instructions.—Complete directions for the installing of a feeding floor can be found in Farmers' Bulletin No. 481. First, put down a 4 or 6 inch layer of gravel or cinders, which should be wet and well tamped. On top of this should be placed the concrete floor, which can be 4 or 6 inches thick. After the floor is laid, be sure to make the surface rough by using a wooden trowel, which can be easily made from a 1 by 6 about 12 inches long, with a handle placed on it. When the floor is finished, keep it covered from the sun and wet it every day for a week.

EXERCISE 18. CONSTRUCTING AN INDIVIDUAL HOG HOUSE.

Equipment.—Lumber, nails, bolts, saw, hammer, plane, square, and screw driver.

Instructions.—Plans for individual hog houses can be found in Farmers' Bulletin No. 438. Your State agricultural college may be able to supply you with plans for a hog house. Figure 22 shows a good house. Make out a bill of materials from the plans. Give the

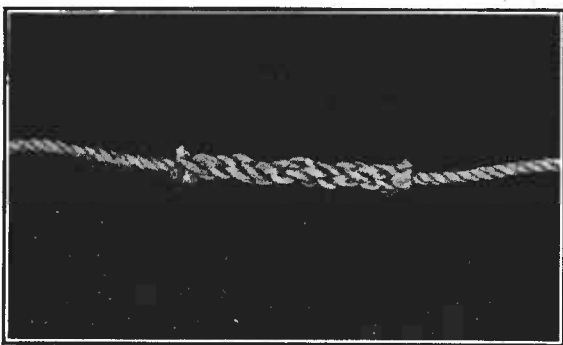


FIG. 13.—The completed short splice.

plans to three students and have them build it: Where funds are not available for the purchase of the lumber, secure the cooperation of farmers in the community desiring to build hog houses.

EXERCISE 19. CONSTRUCTING A TRAP NEST.

Equipment.—Lumber, nails, bolts, saw, hammer, plane, and square.

Instructions.—Figure 23 shows the construction of a Connecticut trap nest. Each student should make one of these, or they should substitute work with exercise 18 or 20.

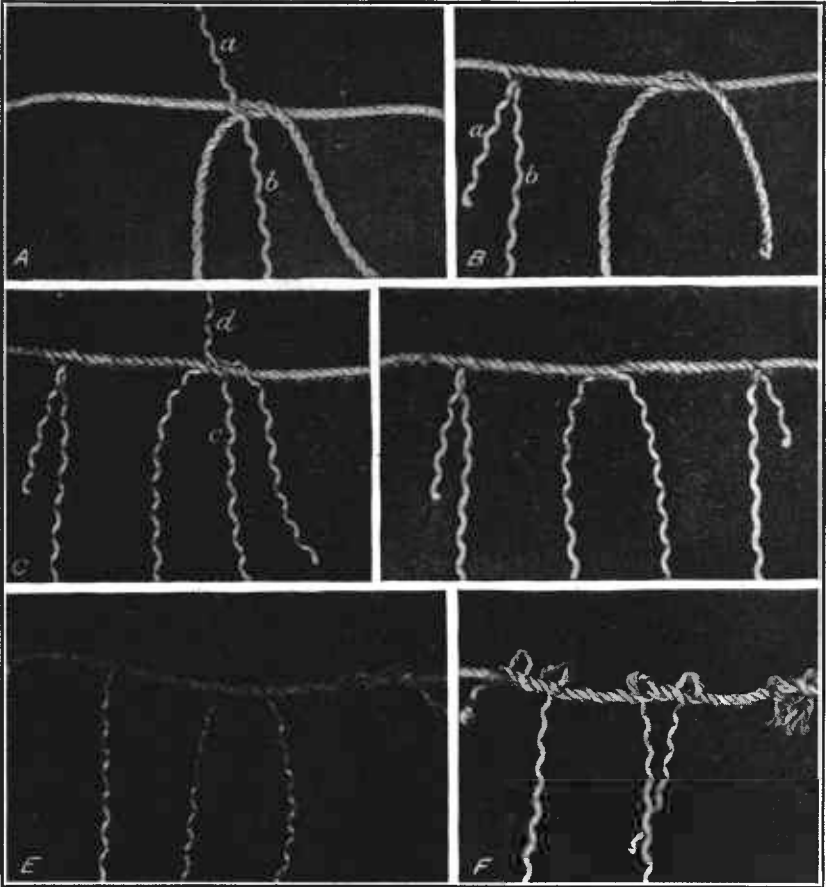


FIG. 14.—Splicing rope with long splice.

EXERCISE 20. CONSTRUCTING A GATE.

Equipment.—Lumber, nails, bolts, saw, hammer, plane, square, and monkey wrench.

Instructions.—Figure 24 shows the construction of a fence gate. This gate can be made any length. It is built up of $\frac{3}{4}$ by 4

inch dressed lumber and either nailed or bolted together. Hinges are shown at one end. After the gate is made it should be well painted.

EXERCISE 21. BUILDING A WIRE FENCE.

Equipment.—Post-hole digger, posts, wire, wire stretcher, nails, staples, hammer, and brace wire.

Instructions.—Holes should first be dug and posts set. Corner posts should be well braced. Then unroll the wire along the line of the proposed fence. Attach one end of the wire to the corner post and put the stretcher on the other end. As to different methods of bracing the corner posts and stretching the wire, write the wire fence manufacturers for information. In this way reliable information may be obtained free. The entire class may be used on this exercise. When all the school fences are up, make trips to different farms and help the farmers with their fences for the experience.

EXERCISE 22. PAINTING AND WHITEWASHING.

Equipment.—Paints, whitewash, and brushes.

Instructions.—

Painting.—In Farmers' Bulletin No. 474 may be found valuable information re-

garding the mixing and handling of paints. The students should mix their own paints if possible, using linseed oil and white lead. They should also learn how to obtain the various common colors by mixing. After the paint is mixed they should apply it. Care should be exercised to teach them how to hold the brush, rub the paint in, and stroke the paint in order to leave a smooth surface. The school buildings and farm machinery could thus be painted.

Whitewashing.—Many formulas for whitewash will be found in Farmers' Bulletins Nos. 474 and 499. All students should be taught how to make Government whitewash, which is made as follows: Slake $\frac{1}{2}$ bushel of quicklime in hot water. In slaking this lime be careful to keep it covered with water and have the vessel covered. After the lime is slaked strain it. Dissolve 15 pounds (1 peck) of salt in hot water and add to lime. Boil 3 pounds of rice to a thin paste and add to the salt and lime. Soak $\frac{1}{2}$ pound of glue overnight in cold water; in the morning pour off the cold water and dissolve

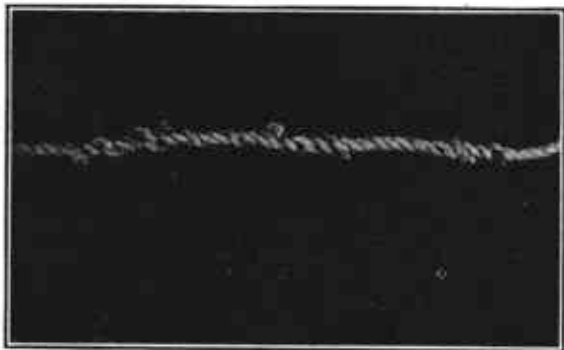


FIG. 15.—The completed long splice.

the glue in 3 or 4 quarts of hot water. Add to this glue $\frac{1}{2}$ pound of Spanish whiting. Then mix all together. This whitewash after being made should be applied by the students to the interior of the barns and chicken and hog houses.

FARM MACHINERY.

EXERCISE 23. NAMING PARTS OF PLOW, CULTIVATOR, AND MOWER.

Equipment.—Walking plow, riding cultivator, and mower.

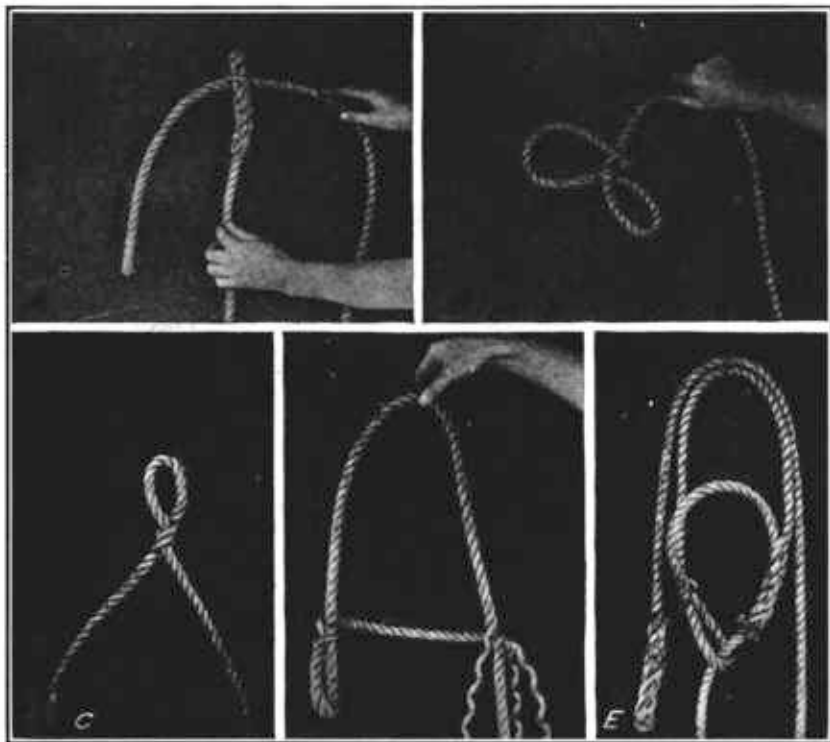


FIG. 16.—Making rope halter.

Instructions.—The student is to locate the parts named on each machine.

Walking plow.—Mold board, shin, share, point, wing, landslide, heel, frog, beam, clevis, and handles.

Riding cultivators.—Rigs or gangs, shovels, shields, beams, frame, seat, arch, wheels, axle, levers, tongue, and hitch.

Mower.—Cutter bar, ledger plates, wearing plates, clips, inside shoe, outside shoe, grass board, sickle, pitman, crank shaft, main gearing, lever for throwing in and out of gear, wheels, seat, levers, with purpose of each, tongue, and doubletrees.

EXERCISE 24. NAMING PARTS OF BINDER, WAGON, AND MANURE SPREADER.

Equipment.—Grain binder, wagon, and manure spreader.

Instructions.—The student is to locate the parts named on each machine.

Grain binder.—Main wheel, axle, main drive chain, countershaft, crank shaft, pitman, cutter bar, ledger plates, wearing plates, clips, sickle, inside and outside divider, grain wheel, platform canvas, reel, elevator, binder attachment, needle, packers, knotter, butter, twine box, twine tension, bundle carrier, transport trucks, each lever, and its use.

Wagon.—Wheels, axles, skein, thimble, bolsters, reach, king-pin, fifth wheel, hounds, doubletree, tongue, brake, and endgate.

Manure spreader.—Box, apron, apron drive, beater, beater drive, rake, wheels, axle, tongue, hitch, levers, and the use of each.

EXERCISE 25. NAMING PARTS OF DRILL, DISK, HARROW, AND ENSILAGE CUTTER.

Equipment.—Grain drill, disk harrow, and ensilage cutter.

Instructions.—The student is to locate the named parts on each machine.

Grain drill.—Seed box, seed cups, agitator, valves, shaft, regulating lever, seed tubes, furrow openers, boots, lever for lifting furrow openers, covering chains, axle, wheels, tongue, and doubletree.

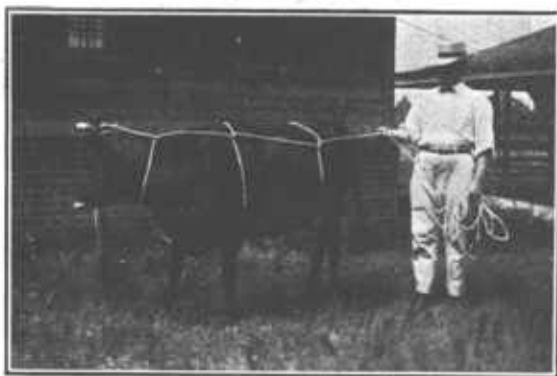


FIG. 17.—Casting cattle.

Disk harrow.—Disks, gang bolt, standards, bearings, bushings, bumpers, scrapers, levers, with purpose of each, weight pans, tongue or tongue truck.

Ensilage cutter.—Knives, blower, pulley, blower pipes, feed table, self-feeding attachment, lever for adjusting length of cut, lever for reversing machine.

EXERCISE 26. MAKING LIST OF REPAIRS FOR MACHINE.

Equipment.—Old machine badly needing repairs. (A mower is best for this exercise, as most students are familiar with it. Get an old mower that has been discarded by the school farm or some farmer in the community. Write the manufacturer of this mower and have him send you repair list. Attach this to the machine. A catalogue showing the machine would also be of considerable help.)

Instructions.—Have students in groups of two or three go over the machine with the catalogue and repair list, making out a complete list of repairs, with prices of each article that would be needed to put this machine in good condition. In making this list of repairs each casting has a letter and number on it. This can usually be determined from the old casting if available. If the casting is not available, the manufacturer's repair list gives a picture of each part and its number. In the list will also be found the name of the part and the price. Parts made of steel and forgings have only numbers as a rule, which must be obtained from the repair list. Often considerable study is needed before the right name and number is obtained. Have each student turn in a repair list showing number of pieces, catalogue number, name of part, and price. If the machine does not need too many repairs it would be well to obtain the repairs, and after the

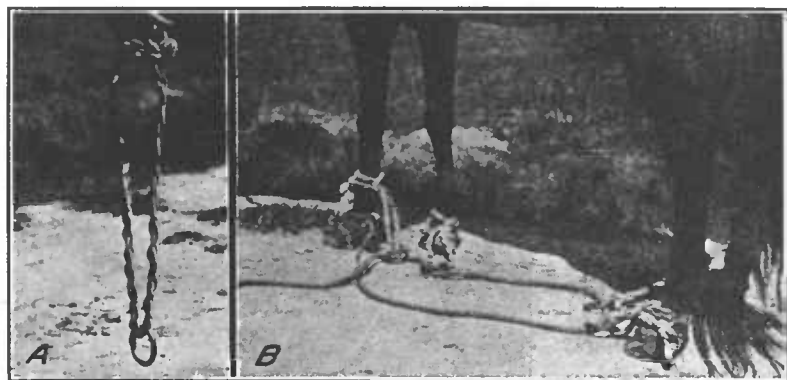


FIG. 18.—Hobble (A) and its adjustment (B) for casting horses.

students have made out the list allow them to put the machine in good order.

EXERCISE 27. ASSEMBLING A MACHINE.

Equipment.—Machine to be assembled, monkey wrench, three or four S wrenches, hammer, cold chisel, punch, screw driver, pair of pliers, and file. (The machine to be assembled may be any farm implement. It would be best to get an old manure spreader, binder, or mower, and use it for nothing else but tearing down and assembling by the students. It will soon ruin a new machine to have it taken down and put up many times by the students each year. The local hardware dealer may cooperate with the school by allowing the students to set up some of his farm implements for the experience.)

Instructions.—If the machine is already assembled, furnish the students with a list of parts in the order in which they are to be removed. Allow only two or three to work on this exercise at a time. When they have dismantled it, they should so inform the instructor.

It should then be reassembled and when this is done it should be made to operate. If the machine is a new one in a knocked-down condition, furnish the students with the manufacturer's assembling instructions and have them put it together.

EXERCISE 28. CORN-PLANTER OPERATION.

Equipment.—Two-row corn planters and team.

Instructions.—First, the corn planter should be fitted up for checking corn. The instructor should show the students how the check operates and when the wire should be moved. Each student should drive one or more times across the field endeavoring to make as straight a row as possible.

Second, the corn planter should be set to drill, the students shown how it is changed over, then several rows of corn drilled with different spacings, showing the students how this is accomplished.

EXERCISE 29. CALIBRATION OF A GRAIN DRILL.

Equipment.—Grain drill.

Instructions.—Place the grain drill in a shed or barn some place out of the wind. Jack it up so that the wheels turn free. Place under the drill some sacks or canvas to catch the seed. Decide on the amount of seed you wish to sow per acre and weigh or

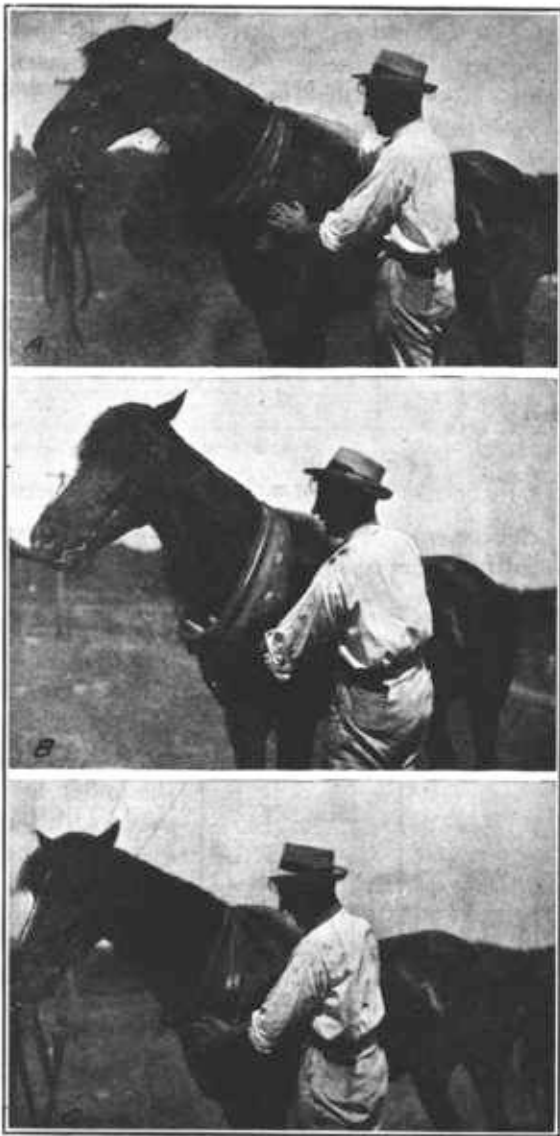


FIG. 19.—Fitting the collar.

measure out this amount. Set the drill to sow that amount. Throw it in gear. Place the seed in the seed box. Measure the circumference of the wheels, also the width that the drill will sow. Determine how many times the wheels will have to revolve to sow an acre. Turn the wheel until all the seed is gone, keeping a record of the number of revolutions made with the wheels. Compute the inaccuracy of the drill in per cent. Reset the drill and find out where the pointers should stand to sow the amount of seed you wish. Students should keep results in the following form:

Calibration of a grain drill.

Kind of seed.	Pounds of seed.	Revolutions of wheel per acre.	Revolutions of wheel to sow seed.	Acres sowed.	Percentage of error.

Pointer should be at — to sow — pounds per acre.

EXERCISE 30. PULLING STUMPS WITH MACHINE.

Equipment.—Stump puller and team. (Stump puller can often be borrowed from some farmer in the neighborhood.)

Instructions.—Complete instructions come with each stump puller.

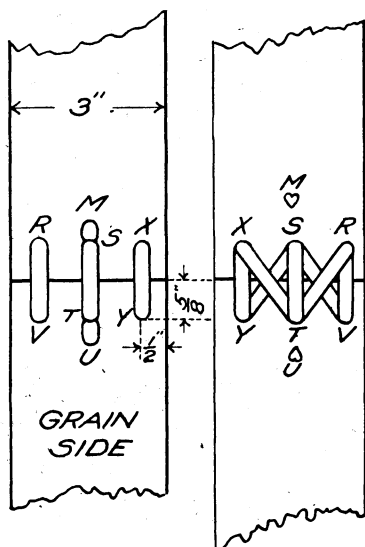


FIG. 20.—Lacing 3-inch leather belt.

The students can be shown how to set the puller, anchor, and attach cables. It would be better to take a day for this exercise. When school lands are not available for the use of the puller, arrangements can often be made with farmers to use their puller and pull stumps on their land. (If no regular stump puller is at hand and a traction engine is available it may be used to pull stumps. Small stumps can be pulled by hitching a cable around the stump and to the tractor and then starting the tractor. Larger stumps must have some of the roots cut and a leverage secured.)

EXERCISE 31. BURNING OUT STUMPS.

Equipment.—Two-inch ship auger with handle (or boring machine),

spade, and post-hole digger.

Instructions.—A hole about 12 inches deep should be dug at one side of the stump and the dirt cleaned away. Bore a hole through the

stump with a ship auger, having it start on the ground line on the opposite side of the stump. The hole bored through the stump acts as a chimney. After the fire is well started it will burn without any further attention. This method of burning only works with fat pine stumps.

EXERCISE 32. DYNAMITING STUMPS.

Equipment.—Dynamite, caps, fuse, crimper, auger, and wooden tamper.

Instructions.—Most of the manufacturers of dynamite issue instruction books on the use of dynamite. These can be obtained free by applying to the manufacturers whose addresses can be found in most farm papers. Dynamite is a dangerous material to handle if considerable care is not taken at all times. The caps are the most dangerous and should be handled with extreme care. In this exercise it would be well to do it with only a few students at a time, as it is difficult to watch and control too many. It is often a great help to obtain, if possible, the services of a manufacturer's demonstrator of the use of dynamite.

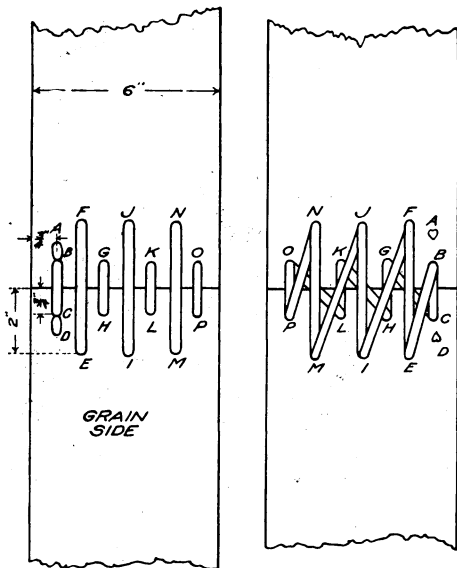


FIG. 21.—Lacing 6-inch leather belt.

SURVEYING.

EXERCISE 33. OPERATION OF A LEVEL.

Equipment.—Surveying level, rod, and hatchet. (Levels can be obtained for from \$15 to \$40. Level rod, \$8.)

Instructions.—Set up and adjust the level. Sight on a starting point or bench mark where the horizontal cross hairs (black lines seen in the telescope) cross the rod and record the reading. This reading is the back sight (B. S.). Add this reading to the elevation of the starting point. If the starting point has no elevation, assume that it is 100 feet. The sum of the B. S. and this elevation is the height of the instrument (H. I.). Send the rodman ahead to the next point, turn the telescope around, sight on the rod, and record the reading. This is the front sight (F. S.). Subtract this from the H. I. and thus obtain the elevation of the point on which the rodman

is holding the rod. Have the rodman remain where he is with the rod on the last point sighted. Pick up level, carry it beyond the rodman, level it up and take another B. S. on the last point. Add it to the elevation of the point the rodman is holding the rod on this time and it gives a new H. I. This is called a turn and the point at which the rodman remains is called a turning point. Have the rodman go to a new point, etc. Always have the rodman hold on some solid point for a turn, even if he has to drive a stake. The horizontal distances of back and front sights should be as nearly equal as possible. Do not attempt to take too long sights as the rod reading is likely to be inaccurate under certain atmospheric conditions. The



FIG. 22.—Mississippi portable hog house.

form for the notes is given below. It would be well for the instructor if he has never used the level to get a standard textbook on surveying, where he can get more complete instructions in the use and care of instruments.

Station.	B. S.	H. I.	F. S.	Elevation.
Start or B. M.				100.0
.....	4.1	104.1	
Turning point.			2.6	101.5
.....	3.3	104.8	
Turning point.			1.5	103.3
.....		Etc.	

Other exercises in surveying could be added as the course grows, such as use of 100-foot steel tape to determine distances, angles, erect perpendiculars; the length of pace would also make a good exercise.

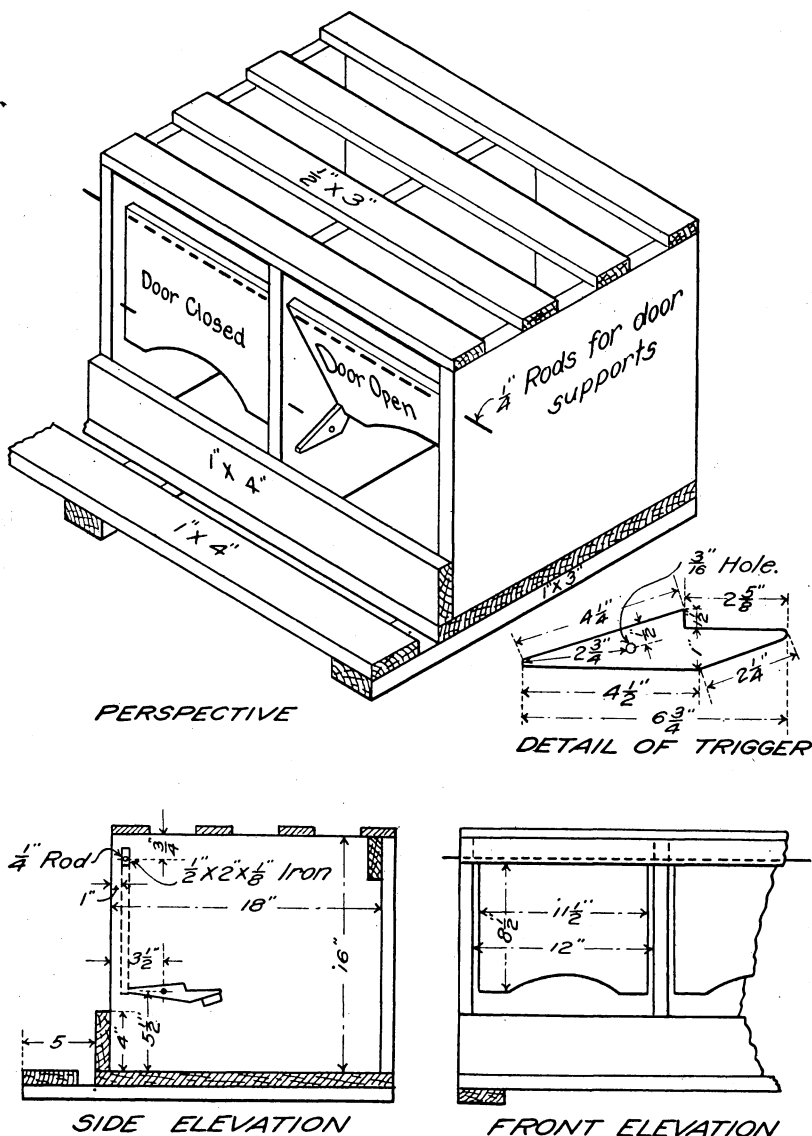


FIG. 23.—Connecticut trap nest.

TILE DRAINS.

EXERCISE 34. TILE DITCH PROFILE.

Equipment.—Level, rod, 100-foot steel tape, stakes, and hatchet.

Instructions.—Place a row of stakes 50 feet apart and 1 foot to one side of the place where the ditch for the tile is to be dug. Place two

stakes out at each point, one stake to be driven even with the top of the ground, the other extending 12 inches above. Take the elevation of the top of each of the stakes driven flush with ground starting at either end. When the elevations are obtained plat them on profile paper. This will show the top of the ground line. Then draw a straight line, with the desired slope, showing the bottom of the ditch. The vertical distance between the top of the ground and the bottom of the ditch will give the depth of ditch or cut. These should be obtained from the profile for each stake. Mark the cuts on each stake. Farmers' Bulletin No. 524 will help with this exercise, also with exercises 35 and 36.

EXERCISE 35. SETTING UP A GAUGE LINE.

Equipment.—Ball of strong cotton twine, long stakes, and hatchet.

Instructions.—Drive a long stake alongside of each of the other two stakes. Have the distance between the top of this stake above the stake driven flush with the ground equal to the difference between

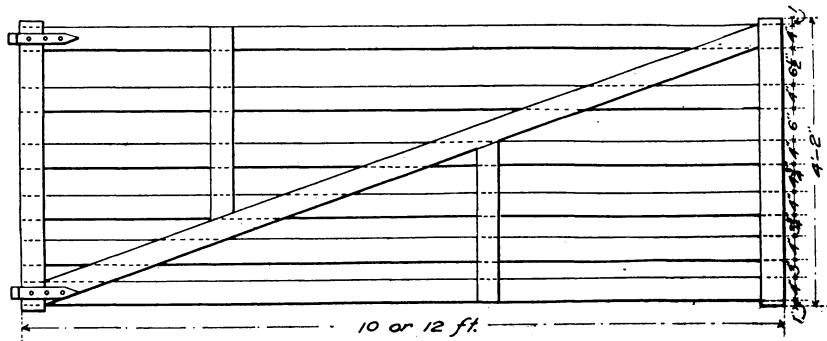


FIG. 24.—Farm gate.

the depth of the ditch at that point and 5 feet. For example, if the ditch is to be 3 feet deep, then the long stake should be 2 feet above other stake. Place these long stakes at proper heights next to all the other stakes. Stretch the twine across the top of them.

EXERCISE 36. DIGGING DITCH AND LAYING TILE.

Equipment.—Gauge pole, tile spade, shovel, ditch cleaner, and tile hook.

Instructions.—The gauge pole is made in the form of a capital L with the pieces at right angles. With the L turned upside down have the distance from the bottom of the L to the underside of the crossbar equal to 5 feet. When the underside of the crossbar is on top of the twine the bottom should rest on the bottom of the ditch. This will show how deep to dig the ditch and when it is at the proper depth. The ditch for a 4 to 8 inch tile need not be dug over a foot wide. Finish the bottom of the ditch with a ditch cleaner. In laying the tile, stand on the bank and use a tile hook.

Your State agricultural or engineering experiment station may have a tile drainage bulletin that will also assist you in this work.

TERRACING.

EXERCISE 37. LAYING OUT AND BUILDING A TERRACE.

Equipment.—Homemade level, or surveying level and rod, hatchet, stakes, plow, team, and scraper.

Instructions.—Either a homemade or surveying level may be used. The homemade level should give good results but its use is slower. A homemade level can be made as shown in figure 25. These may be made 10 feet or a rod long. The 10-foot one can be handled easier by one man. A common carpenter's level is placed on top. To adjust it, set it up on a level spot and place the clips under one leg of the level until the bubble stands in the center. Then change the ends, i. e., place one leg where the other one was and vice versa. If the bubble stays in the center it is in adjustment; if it does not, correct for half the error under one end of the carpenter's level and

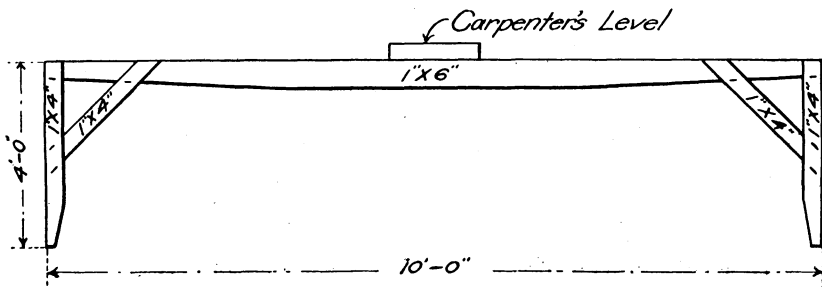


FIG. 25.—Homemade terrace level.

the other half under one leg. Next determine the fall you wish to give the terrace. A fall of 5 inches per 100 feet will be $\frac{1}{2}$ inch per 10 feet. If your level is 10 feet long, tack a $\frac{1}{2}$ -inch block on one leg. Carry the level to the field. Determine where you wish to empty the water and with the leg to which the block is attached placed at this point, move the other leg around until the bubble becomes level. Mark the point where this leg is, then move the entire level forward, placing the leg with the block attached at the point where the other leg was. Turn the level until the bubble comes in the center, mark the point where the front leg is, and repeat until the terrace is staked out.

To build the terrace have the students with a team and plow follow a student who is to show where the terrace is to be built. The last-named student should walk between the stakes, having the team and plow follow him. The plow should be throwing the dirt down hill. The student showing where the terrace is to be built must not follow the stakes too closely but should avoid all the sharp turns and make

gradual curves. After the first furrow is plowed several other furrows, all throwing the dirt down hill, should be plowed alongside of the first. Then take the scraper and move the plowed dirt down hill, making a wide terrace. The Mangum terrace is the best for southern conditions. Bureau of Plant Industry Circular No. 94 gives instructions for building these terraces.

IRRIGATION.

EXERCISE 38. LAYING OFF DITCHES WITH THE LEVEL.

Equipment.—Homemade or surveying level and rod, hatchet and stakes.

Instructions.—Farmers' Bulletins Nos. 138, 158, 373, 392, and 399 give instructions in the laying out and building of small irrigation ditches. Instructors having schools in irrigated sections should provide themselves with these bulletins. The homemade level is made the same way as that shown in exercise 37. The bulletins named also give instructions regarding these levels.

EXERCISE 39. CONSTRUCTION OF A WEIR.

Equipment.—Lumber, sheet iron, screws, hammer, saw, nails, and screwdriver.

Instructions.—Get some reliable textbook on irrigation in which will be found plans for the construction of a weir. It is well also to consult the State agricultural experiment station in this matter.

EXERCISE 40. INSTALLATION AND USE OF A WEIR.

Equipment.—Ax, stakes, level, saw, hammer, and nails.

Instructions.—Textbooks on irrigation should show how weirs are installed and how to read the depths of water running through them. They should also give tables converting the depth of water on the weir to cubic feet per second. Some State experiment stations have published bulletins containing weir tables.

ROADS.

EXERCISE 41. BUILDING A SPLIT LOG ROAD DRAG.

Equipment.—Log, 8 or 10 inches in diameter, 7 feet long; 4 pieces, 2 inches in diameter, $3\frac{1}{2}$ feet long for braces; 4 countersunk bolts, each $\frac{3}{8}$ by 5 inches; 1 piece $\frac{1}{4}$ by 4 inches by 3 feet 6 inches iron plate; 12-foot long chains; 5 pieces 2 by 6 inches by 8 feet for floors; nails and tools.

Instructions.—Split the log into two pieces. Bore 2-inch holes in each piece of the log to take care of the braces. The braces should be wedged into place. Bolt the iron plate into position. Put on the chain and floor. Figure 26 shows the completed drag ready for use. Farmers' Bulletin 597 should be of assistance in teaching this exercise. One or two of these drags should be made for use on the

school grounds and nearby roads. Drags may be made for farmers whose sons are attending school.

EXERCISE 42. DRAGGING ROAD.

Equipment.—Split log drag and team.

Instructions.—Experience will soon teach the proper time to drag the road. The drag does the best work when the soil is moist, but not sticky. For further information in use of drag see Farmers' Bulletin 597.

LIBRARY.

As fast as funds are available, books dealing with farm machinery, gas engines, farm buildings, drainage, irrigation, road construction, carpentry, and forge work should be purchased. A list of these books may be obtained from the professor of agricultural engineering in the State agricultural college. Catalogues of the farm-machinery manu-

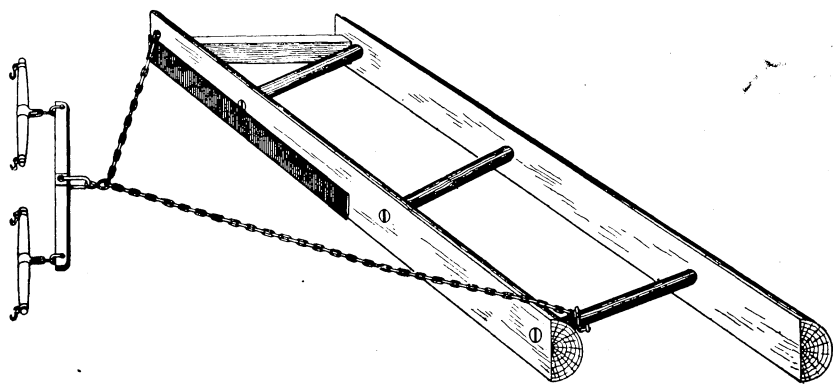


FIG. 26.—The split-log drag.

facturers who sell machinery in the district should be kept on hand in the library. Two hundred postal cards addressed to the different manufacturers will bring an abundance of catalogues. They are particularly valuable not only for the students but also for farmers who will make use of them if they know they are kept on file. A common vertical letter file case is the best for filing them. Place them in alphabetical order with regard to the manufacturer's name. Subscribe for the farm machinery papers, a list of which may be had from the editor of any farm paper. The publishers of these farm machinery papers issue a book each year giving the names and addresses of all the manufacturers of farm implements in this country, also the kinds and names of implements they make. This should be a very valuable reference book. The papers dealing with the construction of buildings, gas engine, and threshing work will also be found of considerable interest.

LABORATORY EQUIPMENT.

In buying supplies for the farm mechanics' laboratory stress should be laid on the fact that it is for school use. This will often obtain special discounts. If a few pieces of farm machinery are needed for exhibition purposes, very often they may be obtained on a consignment basis either from the local dealer or the manufacturer. Lantern slides of farm machinery, cement and its uses, may often be obtained from the manufacturers.